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London penetration depth in the tight binding approximation: Orthorhombic distortion and oxygen isotope effects in cuprates

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Abstract

We present a simple derivation of an expression for the superfluid density ns ∝1/ λ2in superconductors with the tight binding energy dispersion. The derived expression is discussed in detail because of its distinction from the known expressions for ordinary superconductors with parabolic energy dispersion. We apply this expression for the experimental data analysis of the isotope effect in London penetration depth parameter λ in the BiSrCuO and YBaCuO family compounds near optimal doping, taking into account the orthorhombic distortion of crystal structure, and estimate the isotopic change of hopping parameters from the experimental data. We point out that 1/λ2 temperature behaviour is very sensitive to the ratio 2Δm(T = 0)/kBTc and estimate this quantity for a number of compounds. © 2010 IOP Publishing Ltd.

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